

253. Nanoparticles having oligonucleotides attached to them, the oligonucleotides comprising:

- at least one type of recognition oligonucleotides, each of the types of recognition oligonucleotides comprising a sequence complementary to at least one portion of the sequence of a nucleic acid or another oligonucleotide; and
- a type of diluent oligonucleotides.

254. The nanoparticles of Claim 253 wherein, each of the recognition oligonucleotides comprises a spacer portion and a recognition portion, the spacer portion being designed so that it is bound to the nanoparticles, the recognition portion having a sequence complementary to at least one portion of the sequence of a nucleic acid or another oligonucleotide.

255. The nanoparticles of Claim 254 wherein the spacer portion has a moiety covalently bound to it, the moiety comprising a functional group through which the spacer portion is bound to the nanoparticles.

256. The nanoparticles of Claim 254 wherein the spacer portion comprises at least about 10 nucleotides.

257. The nanoparticles of Claim 256 wherein the spacer portion comprises from about 10 to about 30 nucleotides.

258. The nanoparticles of Claim 254 wherein the bases of the nucleotides of the spacer portion are all adenines, all thymines, all cytosines, all uracils or all guanines.

259. The nanoparticles of Claim 253 wherein the oligonucleotides are present on surface of the nanoparticles at a surface density of at least 10 picomoles/cm<sup>2</sup>.

260. The nanoparticles of Claim 259 wherein the oligonucleotides are present on surface of the nanoparticles at a surface density of at least 15 picomoles/cm<sup>2</sup>.

261. The nanoparticles of Claim 260 wherein the oligonucleotides are present on surface of the nanoparticles at a surface density of from about 15 picomoles/cm<sup>2</sup> to about 40 picomoles/cm<sup>2</sup>.

262. The nanoparticles of Claim 254 wherein the diluent oligonucleotides contain about the same number of nucleotides as are contained in the spacer portions of the recognition oligonucleotides.

263. The nanoparticles of Claim 262 wherein the sequence of the diluent oligonucleotides is the same as that of the spacer portions of the recognition oligonucleotides.

264. The nanoparticles of Claim 253 wherein the nanoparticles are metal nanoparticles or semiconductor nanoparticles.

265. The nanoparticles of Claim 264 wherein the nanoparticles are gold nanoparticles.

266. A method of detecting a nucleic acid comprising:

contacting the nucleic acid with at least one type of nanoparticle-oligonucleotide conjugates according to any one of Claims 237-242 under conditions effective to allow hybridization of the oligonucleotides on the nanoparticles with the nucleic acid; and

observing a detectable change brought about by hybridization of the oligonucleotides on the nanoparticles with the nucleic acid.

267. A method of detecting a nucleic acid comprising:

contacting the nucleic acid with at least one type of nanoparticles according to any one of Claims 243-265 under conditions effective to allow hybridization of at least one of the types of recognition oligonucleotides on the nanoparticles with the nucleic acid; and  
observing a detectable change brought about by hybridization of the recognition oligonucleotides with the nucleic acid.

268. A method of detecting a nucleic acid having at least two portions comprising:

providing a type of nanoparticle-oligonucleotide conjugates according to any one of Claims 237-242, the oligonucleotides on each nanoparticle having a sequence complementary to the sequence of at least two portions of the nucleic acid;

contacting the nucleic acid and the conjugates under conditions effective to allow hybridization of the oligonucleotides on the nanoparticles with the two or more portions of the nucleic acid; and

observing a detectable change brought about by hybridization of the oligonucleotides on the nanoparticles with the nucleic acid.

269. A method of detecting a nucleic acid having at least two portions comprising:

contacting the nucleic acid with at least two types of nanoparticle-oligonucleotide conjugates according to any one of Claims 237-240, the oligonucleotides on the nanoparticles of the first type of conjugates having a sequence complementary to a first portion of the sequence of the nucleic acid, the oligonucleotides on the nanoparticles of the second type of conjugates having a sequence complementary to a second portion of the sequence of the nucleic acid, the contacting taking place under conditions effective to allow hybridization of the oligonucleotides on the nanoparticles with the nucleic acid; and

observing a detectable change brought about by hybridization of the oligonucleotides on the nanoparticles with the nucleic acid.